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AMERICAN INSTITUTE
OF
CONSULTING ENGINEERS

Proceedings of the Annual Meeting
Held January 13, 1941

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AMERICAN INSTITUTE
OF
CONSULTING ENGINEERS

Proceedings of the Annual Meeting
held at the University Club,
New York City, January 13, 1941

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ANNUAL MEETING

of the

American Institute of Consulting Engineers

The Twenty-eighth Annual Meeting of the American Institute of Consulting Engineers, preceded by a dinner at 7.00 o'clock, was held Monday, January 13, 1941, at the University Club, 1 West 54th Street, New York City, Mr. Philip W. Henry, President of the Institute, presiding.

The following members were present:

O. H. Ammann
R. E. Bakenhus
E B. Black
Clinton L. Bogert
Albert M. Brosius
Henry Wolcott Buck
George H. Burgess
George W. Burpee
Montgomery B. Case
John N. Chester
W. H. Coverdale
William P. Creager
George Conrad Diehl
Herman F. Doeleman
Charles H. Dolan, II
Merton L. Emerson
James Forgie
J. E. Greiner
Alonzo J. Hammond
Shortridge Hardesty
Philip W. Henry
W. W. Horner
E. E. Howard
John P. Hubbell
Harold W. Hudson
Irving V. A. Huie
Dugald C. Jackson
Nathan B. Jacobs
Daniel W. Mead
Thomas Meloy
E. R. Needles
Henry G. Perring
William M. Piatt
William B. Poland
J. H. Porter
Henry E. Riggs
Harry S. Rogers
Ralph R. Rumery
Thorndike Saville
Frederick W. Scheidenhelm
Albert V. Sielke
Ole Singstad
L. J. Sverdrup
Edwin F. Wendt
H. E. Wessman
Charles S. Whitney

There were also present the following guests:

Herschel H. Allen
Percy E. Barbour
Joseph W. Barker
Waldo G. Bowman
George V. T. Burgess
Meredith F. Campbell
J. B. Campbell
William Carroll, Jr.
Ralph H. Chambers
Russell Cone
Chandler Davis
L. L. Dillon
F. S. Egilsrud
A. P. Farnsworth
James L. Ferebee
John D. Galloway
Morris Goodkind
David Graham
Victor G. Heiser
Paul E. Hemke
Thomas Hitchcock
Richard W. Horner
M. C. Kennedy
C. S. Klumpp
Henry Krumb
George L. Lucas
Henry J. Masson
E. J. McGrew, Jr.
John G. Munson
John I. Parcel
A. B. Parsons
E. E. Paul
Joseph M. Reeves
Edwin B. Ricketts
George T. Seabury
H. R. Seely
William J. Shea
H. C. Tammen
John F. Thompson
F. E. Turneaure
Arthur S. Tuttle
Stephen L. Tyler
Louis Weisberg
Ralph Whitman
Frederick H. Zurmuhlen

President Henry: Gentlemen: I hate to break into these festivities, but we came here to listen to a very interesting address. As soon as you have heard me for a short time, we will come to the address of the evening. I believe it has been the custom to call upon the different men at the speakers' table to stand up when their names are called, but I will adopt for the moment the modern view-point that anything that is different is better, so I am merely going to call their names in order that you may know who they are. Starting from my left, you have Dr. Louis Weisberg, President, Association of Consulting Chemists and Chemical Engineers; Mr. Frederick H. Zurmuhlen, President, New York State Society of Professional Engineers; Dean Joseph W. Barker, Vice-President, American Institute of Electrical Engineers; Mr. Henry Krumb, Vice-President, American Institute of Mining and Metallurgical Engineers; Rear Admiral Ralph Whitman, Civil Engineer Corps, U. S. Navy; Admiral Reeves, about whom more will be said presently; Mr. George L. Lucas, Vice-President, American Society of Civil Engineers; Mr. Edwin B. Ricketts, Vice-President, American Society of Mechanical Engineers; Dr. John F. Thompson, President, Mining and Metallurgical Society of America; Waldo

G. Bowman, Editor, *Engineering News Record;* and Admiral Bakenhus, one of our own members, Chairman of our Speakers' Committee.

Now, all these men have made a reputation for themselves in engineering or construction, but as you look at them I know you will conclude that they are noted not only for good works, but for good looks as well.

Although I like to break loose from tradition occasionally, just now we have to follow the prescribed procedure of our Constitution and By-laws, and inasmuch as I passed my formative period in the nineteenth century, I am a little doubtful about breaking constitutions and by-laws, no matter how popular that may be in these later days.

First, we have the roll-call. I have been informed by the Secretary—and I generally believe what he says—that he has provided for that.

Next is the reading of the notice of this meeting and the minutes of the meeting of a year ago and acting thereon. As these papers have been sent to the membership and no comments have been received, I assume that they have been approved.

Next is the report of the tellers on the election of members of the Council for the next three years. Mr. Sielke and Mr. Case are the tellers, and I shall ask Mr. Sielke to make the report.

MR. SIELKE: We found there were seventy-six ballots unanimous for the members who had been selected by the Nominating Committee.

PRESIDENT HENRY: I therefore announce the election of Rear Admiral R. E. Bakenhus, Retired, of New York; Mr. Henry Wolcott Buck, of Hartford, and Mr. John P. Hubbell, of New York. (Applause.)

Those retiring are Mr. Clinton L. Bogert of New York and Colonel Henry G. Perring. Both have been conscientious in the performance of their duties as members of the Council. I think that Colonel Perring, who is here tonight, is especially to be complimented because, although he lives in Baltimore, he has missed few of the meetings of the Council the past three years.

As for the third member who retired, that happens to be your humble servant, who becomes now a permanent member of the Council, joining the other Past Presidents in that office.

While I am on the subject, I want to give my hearty thanks to the members of the Institute, as expressed through their Council, for my election to the Presidency. Honors that we receive in later years are doubly appreciated, particularly when they come from those with whom we have been associated for many years. I must say it has given me an extraordinary amount of pleasure to have held this office for the past year. (Applause.)

As to the work of the Institute the past year, details are given in the minutes of the monthly meetings of the Council, which have been sent to the members. The report of the Treasurer in detail will be found in the minutes of the Council Meeting of January 14, 1941. For the first time since 1936 there was a deficit last year, fortunately a small one of $121.67.

Since our last annual report, we have lost three members by death. Will you please stand, while I read their brief obituaries, in silent tribute to Ralph Modjeski, George Gibbs and George B. Gascoigne.

Mr. Modjeski, a Charter Member of the Institute, died June 25, 1940, at the age of 79 years. He was not only an eminent bridge engineer, but he was a fine musician as well. His mother was the celebrated actress, Modjeska, who, with other members of the family, felt that he should become a professional pianist. However, his interest in engineering overcame his musical aspirations, and he entered the Ecole des Ponts et Chaussees, Paris, where he was graduated in 1885. He then returned to this country and had his first engineering position under George S. Morison, one of the leading bridge engineers of his day. When Mr. Modjeski died he had established the record of having been the guiding genius and directive influence in the construction of many of the country's important bridges, solving difficult structural and foundation problems.

Mr. Gibbs, who died May 19, 1940, at the age of 79, was graduated from Stevens Institute of Technology in 1882, and at once became laboratory assistant to Thomas A. Edison. In his early days he became acquainted with George Westinghouse and Samuel M. Vauclain. With these two men he became associated in the development of electric locomotives and the electrification of railways. In this work he was in partnership with E. Rowland Hill, under the firm name of Gibbs & Hill. Electrical installation by this firm comprised 50 miles on the Norfolk & Western Railroad and 130 miles on the Virginian Railway. More recently the firm has had charge of the electrification of the Pennsylvania Railroad from New York to Washington, and to Harrisburg. During the World War Mr. Gibbs was a member of the U. S. Government Advisory Commission of Railway Experts to Russia. Later Mr. Gibbs advised the Ministry of Transport of the British Government on electrification projects on lines radiating from London. Mr. Gibbs was President of the Institute, 1916 and 1917.

Mr. Gascoigne died August 17, 1940, at 56 years of age, with every prospect of reaching still greater heights in his professional career. He took the civil engineering course at Ohio State University and was graduated in 1910. Shortly after graduation he made Cleveland his headquarters, but his work in waterworks and sewerage systems extended beyond Ohio into Indiana, New York, Tennessee, Michigan, Connecticut, Massachusetts, Maryland, Rhode Island and Nebraska. These men who have just left us will live far into the future through their works of engineering and construction.

In addition to its loss of three members by death, the Institute lost two members by resignation—Ralph H. Chambers, who returned to contracting, and Alfred E. Forstall, who retired from active practice.

The five new members who were elected in 1940 are Mr. Harland Bartholomew of St. Louis, city planning; Professor Hugh E. Keeler, Mechanical Engineering, University of Michigan; Mr. Michael J. Madigan, New York, highways and bridges; General R. C. Marshall, Jr., Washington, former Chief of Construction Division, U. S. Army; and Mr. H. Shifrin of St. Louis, sanitary engineering.

The Institute, therefore, showed neither gain nor loss in membership, which remains at 126, the highest at the end of any year. In 1933, President Perin stated that Charter Members formed 23 per cent. of the membership. Now the percentage has be reduced to ten. With the exception of two, all of these men are in the seventies or eighties, so that in the ordinary course of events they will not be with us many years longer. But the places of those who have gone are worthily filled, and the standing of the Institute in the engineering world was never higher. Perhaps we should establish what may be called a life membership, applicable to those who have been members for twenty or twenty-five years, and who desire to be relieved from further payment of dues owing to retirement or to lessened activity. This matter has been alluded to before in presidential addresses, but now that the Institute has reached its thirtieth year, it would seem that some action should be taken.

No doubt many of our members have had the question raised by other engineers as to the value of joining the Institute. This matter has been so much on the mind of Past President Jackson that in a recent letter he formulated reasons for increasing the influence of the Institute through a larger membership. Perhaps in the past the Institute has been too willing to hide its light under a bushel, and therefore now a policy of publicity along modern lines may be in order. At any rate, this matter has been referred to the Development Committee, of which Mr. George C. Diehl is Chairman. If any of our members have ideas on the subject, I know Mr. Diehl will be glad to have them.

As usual, the Council has kept itself informed on legislation and rulings of governmental bodies that affect the interest of engineers. This has been handled by the Committee on Legislation, of which Mr. George W. Burpee is Chairman. In this work the Committee has been posted on legislation in Albany by a subscription to the *Legislative Bulletin* issued by the New York State Society of Professional Engineers. By its membership in American Engineering Council, the Committee has kept track of legislation and edicts in Washington. Owing to the dissolution of American Engineering Council, the Institute will have to make other arrangements for reports from Washington, perhaps through the Chamber of Commerce of the United States, of which it is a member.

Through various committees, the Institute keeps informed on other matters affecting its interests. At the September meeting the Secretary announced that a committee, composed of Messrs Saville, Barrows, Goodrich and McDaniel, had been appointed to consider fees paid to consulting engineers by governmental bodies. At the November meeting Mr. Goodrich made a progress report for this committee.

At the February meeting Messrs. Burpee and Scharff were appointed a committee to ascertain the attitude of the Securities and Exchange Commission on the issuance by the Institute of a statement on Foreign Loans, somewhat similar to its letter of February 15, 1932. At the June meeting Mr. Scharff reported that while he had had a satisfactory interview with Chairman Frank of the SEC, the matter of issuing such a letter would require further consideration.

In February the members were notified of the fees recommended for architectural and engineering services by the U. S. Housing Authority. In July the members were given the "Schedule of Minimum Charges for Services Rendered by Members of the Engineering Institute of Canada in Private Practice, or Acting as Arbitrators or Experts in Court."

In November the members were informed of the ruling by Wage-Hour Administrator Fleming on exemption as a professional worker, administrative employee and executive. In November the Council passed a resolution recording its approval of this ruling, and Colonel Fleming, who was so notified, expressed his appreciation.

As usual, the monthly meetings of the Council were preceded by luncheons at the City Midday Club, 25 Broad Street, New York, to which members and guests were invited. At the February luncheon one of our members, Mr. Fred Lavis, who for some time had been advisor on transportation to the Venezuelan Ministry of Public Works, spoke on the economic problems of Venezuela and the development of transportation by airplane, highway and railway. An abstract of the address appeared in the minutes.

At the March luncheon Mr. Frank Chodorov, Director, Henry George School of Social Science, made an address on "The Function of the Market Place," an abstract of which was sent to the membership.

At the April luncheon Captain Arthur C. Stott, U. S. Navy, gave an entertaining and instructive address on the technical and strategical value of the various types of naval units, including ships and aircrafts. He also presented inside information on the engagement between the *Graf Spee* and three British cruisers off the coast of Uruguay.

In May Colonel Frederick W. Scheidenhelm, one of our members, discoursed on "The Legal Aspects of Federal Power and Waterways Projects."

At the June luncheon Colonel R. W. Hebard, who has been identified for many years with engineering and contracting in Latin America, spoke on "The Panama Canal—Today and Tomorrow." A summary of this address was sent to the members.

In September, Captain John T. G. Stapler, U.S.N., Chief of Staff, Third Naval District, New York, who had recently retired from duty on the South China Station, gave an account of the warfare between Japan and China, based on his personal knowledge.

At the October luncheon Colonel L. Alfred Jenny, one of our members, spoke on "The Balkan Region of Europe—Races and Migration," a region with which he was well acquainted.

Those present at the November luncheon heard Professor Athelstan F. Spilhaus, of New York University, tell about "Modern Weather Forecasting Methods," which are based on certain dynamical laws and known as the "Air Mass" Method of weather analysis and prediction.

At the December luncheon Mr. William Howard Gardiner, former President of the Navy League of the United States, held the undivided attention of his audience by speaking on "The Diplomatic Background of the Navy at Present."

Although the activities of the Institute naturally are directed to the interests of its own members, nevertheless on various occasions it has spoken in favor of consulting engineers in general. Three years ago it published a brochure, "The Consulting Engineer," of which 900 copies were circulated among engineers and other interested parties.

Late in 1940 the Institute called attention of engineers in private practice to the virtues of arbitration, by sending to more than 2,000 consulting engineers (so listed in the five National Societies) a letter signed by the President, accompanied by a sheet issued by the American Arbitration Association. Many replies were received, all of them expressing agreement with the Institute's position, some desiring additional information, which was supplied in detail by the American Arbitration Association.

Also, in a broader engineering field, the annual dinner meeting of January 15, 1940, was given up to papers on "The Cultural Advantages of the Study of Engineering," presented by President William Otis Hotchkiss of Rensselaer Polytechnic Institute, and "The Cultural Advantages of the Study of Latin," presented by President William Wistar Comfort of Haverford College. These two papers, with discussions, were published as a brochure of which at first only 1,000 were printed. The demand, however, was so great that the order was increased to 1,900, of which 1,580 have been mailed to individuals, educational institutions, libraries, etc. Requests for copies have come from as far away as New Zealand.

From time to time we hear rumors that the day of the consulting engineer has passed, as his functions are being absorbed by corporations or by government. But he still persists, and only a few months ago Mr. Waldo G. Bowman, Editor, *Engineering News Record*, asked if there was any brief statement that pointed out the economic justification for the consulting engineer that could be used in answering inquiries. After investigation, Mr. Bowman, who is with us tonight, evolved the following excellent definition:

> "By reason of special training, wide experience and tested ability, coupled with professional integrity, the consulting engineer brings to his client detached engineering and economic advice that rises above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services which do not replace but supplement and broaden those of regularly employed personnel are justified on the ground that he saves his client more than he costs him."

I think that A. M. Wellington, that eminent engineer of another generation, must have had the consulting engineer in mind when he defined (so it is alleged) the engineer as a man "who can do for one dollar what any fool can do for two dollars." For it is the prime function of the consulting engineer to determine the economic soundness of a given project. And certainly his services were never more needed than they are today when the government has embarked on its vast construction campaign for preparedness. If the consulting engineer, to use the words of Mr. Bowman, has the "special training, wide experience and tested ability, coupled with professional integrity," who could better determine the soundness of the various plans submitted to the government in connection with its program of construction? For instance, who could better settle the question as to the suitability of the plan proposed by Mr. Walter P. Reuther, divisional chief of the United Automobile

Workers of America, for the mass production of airplanes in automobile plants about which there is a difference of opinion. I have no doubt that more than one of our members who have specialized in factory methods and management would have little difficulty in finding the proper solution. Whether those in charge of the many governmental construction projects will avail themselves of the services of consulting engineers, not all of whom by any means are enrolled in our membership, is a question that cannot be determined at the present moment. Different branches of the Federal Government are in full possession of the names and classification of those listed as consulting engineers in all engineering societies of prominence.

The Institute has co-operated with the four Founder Societies and other engineering bodies in furnishing the Army and Navy Munitions Board with a classified list of all engineers, including consulting engineers. This same co-operation was extended to the Roster of Scientific and Specialized Personnel, an organization which has been set up in the Executive Office of President Roosevelt under joint sponsorship of the National Resources Planning Board and the U. S. Civil Service Commission. But engineering bodies are doing more than furnishing classified lists of engineers. Among other activities is the formation, noted in this morning's papers, of the National Technological Civil Protection Committee, composed of engineers representing the principal engineering societies of the country. This committee will consider the effect of air raids, particularly on municipal facilities, with recommendations, well in advance for proper protection. It is, therefore, evident that engineers are already preparing for the eventualities that lie before us. No doubt they will play their part in these days of uncertainty and stress, as well as were played by engineers in the World War when they organized the Engineers' Council for National Defense which was concerned with both planning and executing.

Dr. Hotchkiss well said at our dinner last year that "we need in our civilization today, which is a civilization based on science, the habit of quantitative thinking that is instilled daily in every man who studies science or engineering." By quantitative thinking Dr. Hotchkiss means determining the value of a given proposition, whether it be the amount of metal in a given ore or the amount of good in a given law. The fact that an ore contains gold does not make it valuable. It is the amount of gold that determines its value. The fact that a law has good motives back of it does not make it valuable. It is the effect of the law that determines its value. It is hard to conceive of any law that does not do a certain amount of good and a certain amount of harm. But which is preponderant? That is a question that an engineer, trained in quantitative analysis, is well able to judge. And at this particular juncture, when so many proposals are being made in the way of legislation and construction, the engineer should take a leading part in determining their value.

In the early years of the Institute our annual meetings were devoted to discussing various problems facing its members, mostly questions of ethics. The solution of these problems are given in the Year Book of the Institute. The last time at which the entire evening was given up to this type of question was just ten years ago when expert testimony was under discussion. Since 1931 the annual dinner meeting has been devoted to one or more addresses on topics of general interest, followed by discussion. I am sure that our speaker of this evening will give us the same enjoyment and profit that we have realized in the past, both in timeliness of his subject and his intimate acquaintance therewith. We are fortunate in having among our members one who well knows our speaker and his accomplishments, and I shall, therefore, ask Admiral Bakenhus to introduce him. Admiral Bakenhus!

Admiral Bakenhus: Mr. President, Members and Guests:

It is indeed a pleasure and an honor to be assigned the duty of saying a few words in presenting our distinguished guest of the evening.

It takes many years to make a naval officer, and Admiral Reeves not only had all the training and the experience to make a successful officer, but in addition he was born with talents that come but to a few, and he has had the deepest feelings of devotion to the service to fully apply all his capabilities.

It is a matter of great interest to our gathering that Admiral Reeves was educated at the Naval Academy as an Engineer—and when the old engineer corps and the line were joined, he shifted to line duties.

One of the outstanding things that I learned as a student and as a member of the staff of the Naval War College, was the great importance of the naval battle with its outcome deciding the fate of nations. Such a battle, which may be over in a few hours, is one of the most difficult and complicated tasks that can come to the human mind. I know of nothing more difficult or complicated in the way of any operation compressed into such a short time. There are battleships, cruisers, destroyers, submarines, with different speeds, armor and fire power—a hundred and fifty ships and more, all under one man. Then the enemy ships, the weather, the sea, the personnel, moral courage, physical courage, the power to separate the important from the trivial as the battle goes on. It takes almost occult powers and tremendous energy.

The young Reeves showed inherent qualities of this kind. I am told that he played some seven games of chess simultaneously. I do not believe he was blindfolded. As for me, I could never imagine him to be blindfolded either physically by the black handkerchief, or mentally by wrong information, by false doctrine, propaganda or deceit.

As a naval academy football player he was a terror to the opposing team, especially West Point. He showed his great energy and gift for action here. He was the first man to ever wear a football helmet.

It was during the later part of his active career that airplanes were developed and adopted by the Navy. He had the vision to see their capabilities and, more than that, to build up and organize the Naval Air Force of the United States Navy, and there is none finer. The Air Force as he organized it is an essential part of the Navy.

Admiral Reeves was the one man who could and did effectively add to the already complicated picture of the naval battle the additional complication of the air forces. After building up the air force while in command thereof, he then became successively commander of the battle force with full rank of Admiral, and was then twice selected by the President as Commander-in-Chief of the United States Fleet.

Mr. President and Gentlemen: Admiral Reeves.

Admiral Reeves: Mr. President and Gentlemen: I want to thank my old friend, Admiral Bakenhus, for his very flattering introduction.

Warfare, like engineering and all other professions in our ordinary, every-day life, has become a complicated business. Many centuries have passed since the first Greek sea captain double-banked the oars of his fighting boat and perhaps thought that he had a battleship, and the second sea captain put three tiers of oars in his trireme and no doubt thought he had a superdreadnought, and the third sea captain who reinforced the prow of his fighting craft and conceived the idea of ramming the enemy was perhaps the first over-optimistic enthusiast who believed that the ultimate in naval warfare had been achieved; that a weapon had been invented which made obsolete all the old battleships of that day.

That belief has been repeated through the centuries with the invention of every new weapon—gunpowder, rifled cannon, steam, armor-clads, torpedoes, submarines, and aircraft. All these inventions have added to the complexity of war, have changed strategy and tactics. But the nature of human beings has been little changed. Today they are destroying one another with the same savagery of ancient times, employing all the weapons that science has given them to make a fine art of this profession and employing also all the weapons of ages past. No weapon, apparently, that is capable of destroying human beings is ever obsolete.

The principles of war remain unchanged. They are a modern addition to this art of conducting war. They are derived from the study of history, of past battles, and these principles today guide the leaders and commanders of armies and navies in their conduct of warfare. You can imagine the responsibility that rests upon the shoulders of the commanders and leaders of armies and navies and how a lifetime of study is required to master this one profession. Not only do the leaders require training, but the ordinary fighting men, the privates in the ranks and the sailors in the ships, must today be trained in the skillful operation of all these weapons and engines of war.

The invention of aircraft was early recognized in the Navy as an invention of marked importance. How these airplanes could fight at sea, no one knew. For years little progress was made. These planes were flown and little was accomplished except the flying of the planes themselves. But some fifteen or more years ago the Navy undertook a careful study and analysis of the capabilities of this new weapon, of its adaptation to naval use, of its co-ordination with the tactics of surface vessels and of submarines.

These studies were all on a practical basis. When I took command of the Fleet Air Force in 1925, I announced that I reserved the right to change my opinion overnight. No one knew much about aircraft. No one really knew anything about its tactics or its employment with the Fleet. All our work had to be experimental, by trial and error; and the young aviators in the Fleet studied and analyzed every problem in the air, of approach, of attack upon other ships, of defense against such attack. Then the study progressed farther—how these tactics could be co-ordinated to assist and aid the Fleet in its mission.

I will come back to that in a moment, but here let me say that the lessons those young men studied and learned and the answers and results which they obtained have been confirmed by all the actual fighting in China and in Europe that has occurred since that time. It is gratifying to know that the thoroughness of their work was so complete. Not one new thing has been developed in any war anywhere that those young men didn't know in our Navy twelve or fifteen years ago. Dive-bombing was invented by these young aviators in our Navy; not only was it invented, but its technique was developed to a point of skill that I think it is doubtful has been reached in any actual warfare.

One of the lessons we learned was that an airplane could destroy battleships. There was nothing new, there was nothing startling, in this discovery. Battleships have been subject to destruction ever since battleships were designed and built. They have been vulnerable to shells fired from guns, to mines planted under the water, to torpedoes fired by destroyers or submarines. An impregnable battleship is a fantastic dream, and there is nothing startling or new about the fact that battleships can be damaged or sunk by bombs dropped from airplanes. There is nothing in that which renders a battleship obsolete. The battleship is in the same status as before the invention of aircraft.

Here, let me give you, as engineers, a mathematical problem to illustrate this point, because you have no doubt read articles written by laymen, lacking in information, lacking perhaps in careful analysis; you have read the advocacy of an air navy; you have read that battleships are obsolete, that they should be superseded by carriers and an air navy. This little problem deals with that question in a practical manner.

In our Fleet today we have fifteen battleships in the battle line. These battleships carry 160 major-caliber guns—let us call it 150 sixteen- or fourteen-inch guns, and, without revealing any confidential information, let us merely assume that these guns can be fired three times a minute. One hundred fifty multiplied by three is 450 major-caliber shells fired each minute by the Fleet against the enemy. It would take 450 large bombing planes, each carrying a 2,000-pound bomb, to equal the destructive power of our battle line.

Let us assume, next, that there are fifteen battleships in the enemy line equal to ours in number. That means thirty planes for each enemy ship. Each minute thirty planes must fly through the same spot in the sky known as the bombing station to drop their bombs upon their target—one plane every two seconds.

Let us assume that this is physically possible. This all adds up, then, to 450 bombers, and it will take seven carriers the size of the Saratoga or Lexington to carry these bombers to the scene of battle, and when this is done we have equalled the gun power of our Fleet for *one minute in time only*.

To protect these bombers and give them even a chance of bombing requires defense fighters. How many? No one knows. But let us assume merely that three carriers are sufficient to carry these fighters to gain what we call command of the air. That means ten carriers are needed to equal the gunfire of our Fleet for one minute; 100 carriers to equal the gunfire of the Fleet for ten minutes; 600 carriers the size of the Saratoga to equal in bombing the gunfire of our Fleet for one hour, which is a reasonable time for the conduct of a naval battle—600 carriers for an hour's battle.

And the question remains whether the first bomber will even then be ready with its second bomb load.

Air navy versus battleship in destructive power: it doesn't look practical. No account has been taken of what will happen to these bombers while they are flying to their target and returning to their base, which is a vulnerable carrier—as vulnerable as an egg shell in its flight deck. No account has been taken of what the enemy will do to that base during this hour.

I must get on and give you a little technical information about the types of planes we operate. Being limited in the air bases, that is, the carriers, both in size and in number, we must restrict the number of types that we operate in the Navy.

First, there is the fighter, single-seater, high performance plane, the fastest plane that can be built, with the most rapid climb possible. Its mission is to destroy the enemy's aircraft. Of course, that includes the defense of our own. We never send out a bombing or torpedo flight without fighters to shoot down the enemy planes that are attempting to destroy this offensive squadron.

At one time they tried to develop a two-seat fighter with a man in a rear cockpit with a gun that fired to the rear. That required a larger, heavier plane, greater horsepower, probably reduced speed and certainly reduced maneuverability. Also, of what use is the gun in the rear cockpit? This fighter in the Army is called a pursuit plane; its mission is to attack. There is no need for it to fire a gun to the rear; that isn't part of its business. So the two-seat fighter faded out.

Next, we have the scout. It is called the VSO. "V" is a designation meaning heavier than air; "S" is scout; "O," observation.

Carriers carry these planes primarily for scouting. I don't need to expand on that except, to point out to you gentlemen that when you scout from a carrier at sea your plane flies hundreds of miles from its base—a single dot in the ocean—and it must find its way back no matter where that carrier steams in the meantime. It must go out, navigate accurately, know where it is at every moment and know what it sees when it sees it. It must report in code in the most terse and exact language precisely what it sees.

I have known a commander to lose an entire campaign on the game board because of one report from one aviator that was true but misleading. I know from experience that every one of a commander's acts is based on the information which he has. He must know it is correct.

It is a vital task that rests on the shoulders of these young naval officers, and only a naval officer is competent to perform that duty. A great responsibility rests upon him; the consequences of error are grave.

The next type is the dive-bomber, the VSB. It is also used for scouting. It is an offensive plane. It carries bombs of heavy weight, not the 2,000-pound bomb, but destructive. It bombs by diving the plane straight at the target until it is at point-blank range. I had to issue an order that these planes should pull out of the dive when they reached 1,500 feet altitude. Of course, in pulling out there is a certain amount of "squashing," as we call it—the plane settles hundreds of feet.

Dive-bombing is the most accurate form of bombing. The aviator uses his telescope sight in the line of flight of the plane. The plane dives down at full throttle in a vertical line. I am speaking of dive-bombing as we developed it—not merely a power glide dive. If you dive vertically, you eliminate many errors, as you can understand—wind, movement of the plane over the surface, gravity; all eliminated. The bomb is delivered like a projectile from a gun at 1,000 or 1,500 feet distance. That is dive-bombing.

The next type of plane we have is the torpedo and heavy bomber. It is a big plane. It carries either a torpedo or the largest size bomb. It is, of course, an offensive weapon. The torpedo is a typical naval weapon. It damages battleships where they are vulnerable, under the water. It doesn't explode on the armored deck; it doesn't explode above water. It will sink a battleship. I believe in the torpedo. If you don't sink the enemy battleship with one torpedo hit, you will damage it; you will slow its speed—and the speed of a fleet is the speed of its slowest ship. The fleet commander must either leave that ship behind for destruction or slow his fleet speed.

To deliver a torpedo plane attack is difficult. You must approach within a few thousand yards of the enemy. Our aircraft torpedoes haven't the long range of the torpedoes fired from destroyers. The airplane must approach the surface of the water, within 50 or 100 feet, aim the torpedo by flying directly in the path the torpedo should follow. It drops the torpedo in the water, and then the plane turns away. Of course, all this time the plane is subject to gunfire from the battle line, from auxiliary vessels and perhaps from aircraft. In our Fleet, we developed a policy of never delivering an airplane torpedo attack without a smokescreen. I will describe that more in detail later. A smokescreen is laid, torpedo planes approach behind it, pass through it, and are visible to the enemy battle line for perhaps thirty seconds in which time they drop their torpedoes. I have seen a whole squadron vanish behind a smokescreen within half a minute.

These planes can also carry bombs, heavy bombs. In true bombing, the plane flies in horizontal flight at a certain known speed, estimates the speed and course of the enemy, drops the bomb from a known altitude, and then the pilot knowing the action of gravity upon the bomb calculates the point at which he releases that bomb and the bomb goes down by force of gravity and, by the grace of God, hits the target. Of course, all of this time he is subject to anti-aircraft fire from hundreds of 5-inch automatic anti-aircraft guns of the fleet. It is a rough reception that these bombers receive in the air over a concentrated fleet at sea.

Furthermore, these bombs, if they strike a battleship, a modern battleship, will strike six and a half or eight inches of armored deck.

There are two types of heavy bombs. One is the armor-piercing bomb, to penetrate this deck; the other is a non-armor-piercing bomb that carries a larger explosive charge. The idea of that bomb is narrowly to miss the ship, and explode just beneath the surface of the water. The concussion of the explosion is supposed to bilge or rupture the hull of the enemy ship below its armor. So you have your choice of these two types of bombs. If you hit the deck you have the chance of penetrating, and if you penetrate you have the chance of exploding a magazine or of damaging boilers or machinery.

It was Theodore Roosevelt who said, only hits count. Modern warfare has modified that expression to this extent: only *vital* hits count.

Battleships at the Battle of Jutland steamed out of that battle with seventeen major-caliber shot holes in them—still fighting; still steaming. None of those projectiles had penetrated the vitals. The armored citadel carried on each battleship must be penetrated before any really serious damage has been done. You may have done a lot of "spectacular" damage—the funnels may be gone, the masts down, the superstructure wrecked, the bow and stern shot full of holes—but the ship is still impregnable until its citadel has been attacked.

There is another type of plane, the VOS. It is similar to the VSO carried by the carriers, but it is an observation plane rather than a scout. Furthermore, it is a seaplane furnished with a pontoon and is carried by our battleships and our cruisers. It is launched from a catapult and it lands on the water and is retrieved by the parent ship.

It is of vital importance; it is one of the most important airplanes in our Navy. It has a half-dozen missions, but its primary function, and the reason why it is carried by all heavy-gunned ships is because it controls the gunfire of our battle line. You hear very little about that in the popular press. You hear about bombs and smoke and noise. They attribute to airplanes powers and possibilities beyond their capabilities, and they omit the vitally important missions of which airplanes are capable; and this control of gunfire is one of them.

Making those 450 16-inch shells-a-minute hit the target is vital in a fleet battle, and their effectiveness is almost wholly, in our Navy, dependent upon aircraft. These planes are the spotters that fly near the enemy target, observe the fall of shot, report to the firing ship and correct its range and its deflection.

It is marvelous what those spotters do. I can't give you the secrets of that performance. Foreign navies would give much to know the methods by which we control our gunfire. It has reached a point of perfection that is unbelievable. Let me tell you just a little of the difficulties which must be obvious to you upon reflection. Fifteen battleships: each battleship has its own spotter. Each battleship is firing at its own designated target in the enemy battle line. Each spotter must report to its own firing ship, and to no other, the fall of the shot from that ship alone, and from no other ship, and he must do it while fifteen other spotters are reporting to fifteen other ships. Well, it isn't exactly simple. In principle it is simple; in practice, it calls for the utmost refinement; for continuous every-day training in the every-day life of the fleet on the part of these spotters, these naval officers, who are naval aviators, to do it.

Picture the enemy battle line: 450 shots a minute, 450 splashes rising hundreds of feet, 450 splashes scattered up and down the enemy battle line, and your spotter picks out your shell, your splashes, and he must not make a mistake—we can't tolerate a mistake—because if he makes one mistake and reports the wrong splash he guarantees, he insures, that your next succeeding salvos will miss as certainly as he makes a false report. Otherwise you have a chance in a million that if you shut your eyes you might hit the enemy, but when he gives you a false splash report he insures you will miss the enemy. So we can't tolerate a mistake; and I don't think he has ever made a mistake. He picks out the right splash, he reports to the right ship, and he reports almost with a vernier eye the correction in range and deflection to bring the next salvo on the target.

I can't go on and relate to you in detail the more marvelous things that our spotters do. Our 16-inch guns range up to 30,000 and 40,000 yards, 20 miles and more. At these ranges the enemy battle line is below the horizon; you can't even see the tops of his masts from our fighting tops. But our guns will shoot that far and our guns should hit that far. Aviation: Can you think of anything more vital to our Fleet than what those airplanes are doing in controlling the gunfire of battleships?

Performance: I can't give you the latest performance of our airplanes. I think that our airplanes are equal to any in the world. So much has been said in exaggerated nature about the speeds of aircraft of 500 miles and more that when you read in the press of a fighter that has attained a speed of over 400 miles, it receives but scant attention; and yet it is the fastest airplane in the world.

In our large airplanes, our flying boat type, which I haven't yet described, we have always been ahead. That is called the VPB, the heavier-than-air patrol boat. It is an enormous boat. We classify them A, B and C. (A is average; B is big; C is colossal!) A weighs from 20 to 30 tons; B weighs from 30 to 50 tons; C anything over 50 tons—50, 60, and even 70 tons flying through the air, 4-engined boats, operating from the water, under Fleet command, and absolutely essential to the Fleet, operated from any sheltered cove or harbor, with a range of thousands of miles.

Armored planes, heavily armored planes, carrying several torpedoes, or carrying thousands of pounds of bombs! When I say thousands of pounds, I don't mean five or ten; I mean thousands.

Now, these planes fly enormous distances. They patrol. The element of surprise is largely eliminated by all these scouts from carriers, these flying patrol boats, but the primary mission of the patrol boat is to strike at a distance. You can't stop a flight of airplanes in the air. We knew that fifteen years ago. It can't be done the way you stop a fleet or an army—this far and no farther. You can shoot down a lot of them; but you can't stop a flight.

The most effective defense against air attack is at the nest, at the base, from which these planes operate. The first, primary tactics of our Fleet are to seek and destroy the enemy carriers. A carrier commander or an air commander whose carrier deck is bombed by enemy planes with his planes still on deck has suffered the worst defeat in the aviation part of our Navy that any commander can suffer. He must get his planes off before he gets bombed, if he gets them off at all. He doesn't get bombed if he can help it, and our carriers don't get near the scene of battle for that reason. They operate at long distances from the battle line. The enemy has to seek them and find them and send attacks against them before they can bomb them. We preserve these fragile carrier decks to the maximum extent. They are vital to the Fleet, as I hope you have already realized.

So much for those flying boats. I can't go on with the performance of our planes. Our dive-bombers, I think, probably are the fastest, most effective dive-bombers that exist. Of course, we haven't got enough airplanes.

I have here a note: "Production." Well, that's largely in the future. The Navy has some thousands of airplanes today. I think the papers published 3,000 planes, which I think probably is somewhere near right. I think the papers have also published that during this year the Navy will receive between 300 and 400 airplanes a month. That means some more thousands of planes by the end of this year, and, of course, the production will go up and up. We have the capacity and the facility unequalled by any country—once it gets under way.

Aviators in the Navy: There was a time when I knew every aviator in our Navy. I even knew him in the air by the way he flew, the way he made his approach to the carrier, and the way he landed. Today, we are recruiting and in the course of time we will have 16,000 naval aviators to man a maximum allowed number of 15,000 airplanes.

There has been nothing in my knowledge that has developed with such rapidity as has aviation in the last few years, the last ten or fifteen years. Fifteen years ago when we landed planes on the carrier, it was an ordinary sight to see the wooden struts of these planes go flying in the air. I remember an aviator, when the Assistant Secretary was aboard, who made a perfect landing, a strut broke and he came down on the deck on one wing. The aviator hopped out of the plane, picked up the wooden strut, rushed over and said, "Admiral, rotten wood; dry rot!" He was right.

We don't have that now. A lot of the thrill has gone. You don't see so many crashes and casualties.

I have told you the mission of the air force in detail. The mission of the air force of the Fleet in general words is this: To aid the Fleet to achieve victory. That is the general mission of the air force, and it is divided into a dozen minor missions; and the types of planes have still other minor missions, all supporting the one supreme mission: to aid the Fleet in achieving victory.

Smokescreen: A difficult, delicate and dangerous thing to monkey with. A smokescreen drifts with the speed of the wind. It must be laid in exactly the right place at exactly the right time, or it may do you more harm than it does to the enemy. Airplanes are ideal for laying smokescreens. We have gone far in developing the tactics and technique of smokescreens. We use them in airplane torpedo attack; we use them in destroyer attack, to protect these vulnerable, tinsel boats and our vulnerable airplanes; we use them to blanket the enemy, who can't fire through a smokescreen. We use them to smoke off the enemy, render his fire ineffective, and if he can't fire at you and you can fire at him—why, it's a cinch!

Airplanes co-operate with submarines. They co-operate with our submarines by finding the enemy, informing the submarines, so that the submarines can get in the path of the enemy in time to make an approach and an attack.

Airplanes against enemy submarines: one of the most vital and most effective weapons against enemy submarines. I took the entire American Fleet from San Francisco to Honolulu in a Fleet war maneuver against seven submarines with a surface speed of 22 knots and 40 more submarines waiting near Pearl Harbor, and not one of those submarines even sighted one ship of our Fleet, and the aircraft did it. It was a new method, new tactics, that I don't wish to describe. But the submarines didn't, and couldn't, get within sight of our concentrated Fleet. A fleet at sea, in the open sea, free to maneuver, given average flying weather, doesn't need to fear submarines to the extent that the public believes. In restricted waters, yes, submarines are a menace. They are always a menace. But there are tactics to meet that, as there are tactics and defense against every known weapon.

Destroyers—airplane smokescreen aids the destroyer in delivering his attack, and the most effective torpedo attack that is possible is a combined destroyer and airplane attack. When torpedoes are fired from one point, from one squadron, the torpedoes run on parallel lines, and the chances of hitting a ship in the battle line are about one in seventeen torpedoes. That is mathematical. But if they are fired criss-cross, the chances of hits are improved, and if your destroyers attack on the engaged bow while the airplanes attack on the disengaged bow, firing torpedoes at an angle of about ninety degrees, one on one side and one on the other, if you turn the battleship parallel to the torpedoes on one side, you present a full broadside to the torpedoes from the other side, thus rendering possible a maximum number of hits. And so our torpedo attacks are often delivered by destroyers and airplanes, synchronized, co-ordinated. They don't drop their torpedoes at the same instant, but the torpedoes reach the target at the same moment. Not so simple to bring off. It is simple in principle, but it requires skill, co-ordination of the highest degree.

Airplanes and destroyers: The enemy is making a destroyer attack. One of the most effective defense weapons is the dive-bomber. Every airplane we own can carry a bomb; even the fighters carry two 100-pound bombs. Even the fighters with these bombs are destructive against destroyers with their thin decks and thin skins.

We were developing the dive-bomber in a machine gun attack—strafing we called it—we were using 50-caliber guns and had an old destroyer as a target, and we almost sank it. The 50-caliber bullets went right through the bottom.

This is a brief picture of aircraft with the Fleet—submarines, offensive and defensive; destroyers, offensive and defensive; battleships, offensive and defensive, the security of the battleship.

The Fleet in cruising and, in fact, at all times depends largely on aircraft. No fleet, no modern fleet, with a modern air force cruises without an air patrol miles ahead. Other planes patrol immediately overhead to prevent an air attack. Another patrol is looking for submarines, spotting them under the surface. Patrol all the time—protecting the Fleet on the high seas.

When I speak of aircraft—bombs versus guns—don't think I am minimizing the effect of aircraft. It is vital to success at sea, in the hands of competent, trained men, who know how to operate with the Fleet, aviators who are as skilled and courageous as the aviators of our Fleet. I could talk to you for an hour about the acts of bravery and of courage that I have seen during my five years in command of the air force. There is no group of men that has excited my admiration to a higher degree than these young aviators, *naval* officers, *naval* aviators.

I would like to go on about battle ranges, about my friend, Admiral Bakenhus, who was my assistant when I was head of naval tactics at the Naval War College, who worked out tables of ranges, of favorable and unfavorable battle ranges.

Only vital hits count. No skilled naval commander today fights his fleet at a range where his shell can't penetrate the armor of the citadel of the enemy ships, and if he can find a range where he can penetrate their armor and the enemy can't penetrate his, that is a favorable battle range.

Now, there are several of them. On the game board we once played four foreign ships against four similar ships of ours. In one range we licked them; in another they licked us; and in a third we licked them again—all depending upon whether their guns, their projectiles, would penetrate our armor or our projectiles would penetrate the enemy's armor.

These penetration figures were got from practice tests in our ordnance department—not mathematical formula, but actual penetration by actual shell.

A 90-degree normal impact, of course, gives maximum effect. If the shell is tilted, if the target is at an angle, you don't penetrate so much, and so we made out tables for target angles of 90 degrees to 60 degrees, because any commander can always present a 60-degree target angle to the enemy without losing any of his broadside fire. When he reaches a range where the enemy is penetrating his side armor at a 90-degree target angle, he turns toward the enemy or away from the enemy and reduces the target angle to 70 or 60 degrees, still maintaining his full fire effect from all his guns.

Also there are the problems of angle of fall and of zones of immunity. At certain ranges, you cease to penetrate the side armor because your angle of fall is too steep, your shell won't go through, and when you stop on the side armor you begin to hit on the deck armor, the horizontal target. If you hit at too acute an angle you don't penetrate the deck, but at maximum range the fall of shot is so nearly vertical, that there is no deck afloat that will keep out 16-inch shells at maximum gun range. I call that range the "fatal zone" because every fleet in the world has got to pass through that zone before it can reach any other zone, and if we can fire effectively at 30,000 and 40,000 yards and bombard the horizontal armor at a vertical or nearly vertical angle, and the enemy can't shoot at all at that range, every hit we make is vital, and we aren't even exposed to any danger.

Then there is the zone where we cease to penetrate the deck armor and can't penetrate the side armor—zone of "immunity." Then we come to a closer range where our shells penerate the side armor, another favorable zone for fighting.

So this fighting business isn't so simple as it looks. We even developed tactics in the Fleet to shift a squadron of ships from one position in the battle line to another after airplanes had reported the disposition in the enemy battle line so that we could oppose favorable ships against enemy ships to our advantage, on account of guns and armor. It makes a difference whether you fight one type against a certain type, or against some other type.

Another thing about bombing: Horizontal bombing must be done at extreme altitudes. It is going higher and higher; it is going up to 40,000 feet; it is going up beyond searchlight rays; it is going up to extreme gun range; it is going as high as the airplanes can fly. No horizontal bomber dares fly over a fleet or an anti-aircraft battery at relatively low ranges. The accuracy of the defense is growing so rapidly that they are losing their airplanes too fast.

What does that mean? In the most favorable climatic zones at sea, you can bomb at high altitudes only about thirty-five per cent. of the time. Only about thirty-five per cent. of the days in a year permit you to bomb at high altitude because of the ceiling; that is, clouds at a lower level militate against this offense, and it is one of the strongest arguments, to my mind, against the use of bombers and against placing your whole reliance upon them because no able or intelligent commander wants to leave the fate of battle in the hands of Providence. He will control every element, every factor, that he can possibly control, and when it comes to high altitude bombing he has lost control and can only pray.

No battleship has ever been sunk by bombs with the exception of the one that we deliberately bombed and bombed and bombed, and I understand they had to sink her afterwards otherwise. Of course, she was an empty hulk. She had no defense. The bomber had everything in his favor, except that the battleship carried no ammunition. The greatest menace to any war vessel is inside her hull—the powder and explosives that she carries—and when she is sunk, aside from mines and torpedoes, it is almost always the case that she is sunk by explosion of a magazine. No battleship in war has ever been seriously damaged by bombs. By "serious" I don't mean destruction of upper works. I don't know how many battleships may have been hit by bombs, but certainly none has ever been sunk or seriously damaged. It doesn't mean that it isn't possible, and the only thing that has surprised me in the war in Europe has been the success of the ships operating in restricted waters, subject to the attack of shore-based airplanes. That places a fleet at a disadvantage parallel to the disadvantage which a fleet suffers when it attacks shore fortifications. The advantage is all on the side of the stable shore establishment, with its almost unlimited capacity in guns and airplanes.

In the war that is going on today, ships operating in restricted waters within fifty miles of shore bases in narrow straits and elsewhere have survived, and it is surprising that they have done so.

Of course, there have been ships sunk by aircraft. Destroyers and cruisers have been damaged. You read of heavy cruisers that have been sunk by bombs, but later there is always a doubt. Personally, I doubt that any cruiser has been sunk by bombs up to the present time. Torpedoes, yes.

And let me mention Taranto in passing. There the British used the real weapon. They attacked the Italian ships with torpedoes, and they sank them by an effective naval weapon. I don't mean the bombs shouldn't be used. I don't mean the bomb isn't destructive against cities like London and Berlin and Hamburg. Yes; but is that bombing accurate? It is carried out at night. They are bombing a vast area. Flares have been set off. Night bombing has not reached its perfection. At present it is pretty much dropping bombs at a mass collection of houses, and, of course, there is destruction—men, women and children are slaughtered. It isn't military bombing.

Weather: Of course, weather is a vital factor for the air force, but weather today in modern warfare is almost as important to battleships and surface craft, and commanders need more than a local forecast; they need a long range forecast for the campaign. The papers tell you that Hitler didn't invade England because he couldn't get favorable weather reports for a long enough period of time ahead. A commander in planning a campaign wants to know what kind of weather he may expect. It affects not only his air craft but everything else.

In our Navy, we have officers especially trained. They are called aerologists. Some of them take that up as a life profession. They are skilled in forecasting. We have established a system of forecasting from here to China, and that is not too far. We want to know what is going on farther to the west because that is where the weather comes from, and these aerologists are good. They are skilled. I remember one day, in command of the air force, when we were to have fleet operations, asking my aerologist what ceiling we would have the next day. His answer was prompt He said, "What ceiling do you want, Admiral?" (Laughter.) Yes, sir, our aerologists are good!

We have today twenty-six air stations in commission or being built. In addition to that, there are sixteen Naval Reserve air bases. These are bases where Naval Reserve officers are trained preliminarily before being sent to Pensacola. We have four schools —Pensacola, Jacksonville, Miami and Corpus Christi. Pensacola was the only school in existence when I went to school, and the course was nearly a year. They have shortened that to six months, and in a short period of time we will turn out of Pensacola 2,500 trained naval aviators in a year, the same number from Corpus Christi, a somewhat smaller number from Jacksonville. Miami is reserved for the training of aviators in carrier tactics alone. I hardly mentioned that, but the technique of landing on a carrier and of taking off from a carrier and operating on a carrier is an art in itself.

Of these thousands of aviators, some thousands of them will be regular naval officers; others will be reserve officers who will perform at least two years of active service; then go into inactive reserve. This group of four, five or six thousand reserve aviators will be maintained by a fresh input as they go out after two years.

That is the picture, briefly, of our expansion in our Navy and the air force. We have today six carriers, five under construction, and seven appropriated for, a total of eighteen. In addition to that, auxiliary vessels are tagged ready to have flight decks built on them. We had the old Langley when we started; later the Saratoga and Lexington.

Now we will soon have eighteen carriers and 15,000 planes. Battleships and guns, airplanes and torpedoes are essential in war, but the vital essence of victory lies in the ability and the character of the men. (Applause.)

President Henry: Gentlemen, we have listened to a magnificent address. Admiral Reeves has been kind enough to say that he would be glad to answer any questions which may be asked from the floor.

Mr. Burpee: Mr. President, last year on this festive occasion, stimulated by the debate on the relative merits of the classical and engineering education, I ventured to indulge, among other things, in some Latin and Greek quotations, and I was put to rights as to my Latin by Colonel Lacey Hall. I, therefore, am afraid tonight, having been defeated by the Army, to use my Latin quotations in questioning the Navy, so I will confine myself to English, which I hope may be plain.

Admiral Reeves has given us a wonderful picture of the development of the naval air arm, so complete as to preclude many questions other than those that might be embarrassing from the point of view of the Navy.

There is one question that occurs to me that may be of some general interest, and that is this: granted that the Navy needs its eyes under its own control and that the Army needs its eyes under its control, is it possible to secure a degree of co-operation between Navy and Army in the development of the details of aircraft, say, in the design of motors, so that the same motor could be developed which would be useful in naval aircraft and also in military aircraft —that is, either air-cooled or water-cooled, for instance—or is it necessary for the Navy to have its own details and the Army to have its own details?

Admiral Reeves: That is a question of the power plant in the airplane. Of course, the Navy uses air-cooled almost exclusively. I see no reason why the same engine can't be used in either an Army plane or a Navy plane. What we want is the power, and in that respect in this country we have the highest-powered airplane engines, I think, of any country. We are able to produce them in mass production.

I should say that there is no overwhelming difficulty in having the same type of engines for both Army and Navy planes. Of course the design of the plane is sometimes affected by the type of engine that is installed, but I don't think that would seriously affect the problem. However, there is a difference in the design of planes for Army and Navy; there must be. Our planes have to be stronger than the Army planes to withstand the shock of landing on carriers and on the sea. They are built differently, stronger, heavier; but I think they could use the same power plant. I wouldn't like to answer definitely, but in my opinion I see no outstanding difficulty. They can't use the same airplanes in the Fleet and ashore for the reasons that I have given.

Mr. Dolan: I am an advocate of a separate air force; have been in aeronautics for twenty-six years, so anything I might say is subject to be tempered, naturally, by the fact that I am an advocate of a separate air force.

I am an old pilot. I flew for twenty-three years. They are about to test a bomber on the West Coast—the B-19—which has a range of 7,500 miles, carries a bomb load of roughly eighteen tons—and so forth. It is a flying battleship. It can stay in the air thirty hours, roughly. It can take off fifty miles back from the shore line of say San Francisco, fly to Tokio, and return. Where and how and when is a naval fleet able to counter such a fleet of aircraft; can naval vessels function countering such a force?

I am talking about flying battleships and not little "pursuit planes" of short range, stationed on aircraft carriers.

The Navy has done wonderful work in developing long range bombers, far in advance of the Fleet, but I can't see where the Navy has trained men, or how a battleship can counter anything of the magnitude of that B-19 bomber. I am talking hypothetically of a fleet of twenty of those planes, which would probably cost $5,000,000 apiece. A fleet of those planes could be built for the price of one battleship. I mean, that is one of the arguments against concentration of the power and force and what-have-you that is in a single unit battleship.

When planes have high altitude (and as a general told me on his return recently from aviation observation in England) aerial gunnery is just about as poor in this war as it was in the last one, and therefore very ineffective over 10,000 feet, and having been shot at myself, and sometimes wondered whom they were shooting at, I have no respect for anti-aircraft fire. In fact, I am like Josephus Daniels, who said, "I would stand on the bridge of any battleship and let them bomb me." I (C. H. D.) would sit in the average airplane and let the average anti-aircraft gunner shoot at me.

The unsinkable German battleships, equipped with water-tight compartments, that were bombed and sunk in Chesapeake Bay—the bombs never landed on the decks—I have some aerial photographs of those ships bottom-side up in ten minutes, the Navy *"au contraire."*

Admiral Reeves, in fairness to the Air Corps—and I highly respect the Navy—I think the Fleet air arm is a wonderful asset to the Fleet, our country and our Navy, just as much as our Army Air corps is a wonderful asset to our Army. But there is another force that we have our hopes in to bring us out of this chaotic mess in Washington now—an air arm that is independent of both the Fleet and the Army. It is beyond the training of an Annapolis and a West Point man to conceive the rapid movements of those large air fleets for covering great distances rapidly, concentrating and moving in and out. They cross this country in fifteen hours, go to Hawaii in twenty hours; while you move a concentration of battleships 200 miles, you can move the aircraft at least a thousand miles.

I would like to know from a man of your experience how the Naval Fleet could counter an air arm as such operating independently from bases beyond the Fleet's guns and way inland, going great distances to the objective (the base of the enemy naval fleet), which is where one should strike them. I can't see where the Naval Fleet is of any value there. I am wrong, from the naval point of view, but not in my own, after twenty-six years in aviation.

I am sincere when I say that there is a doubt in the public's mind, and there has always been a doubt in my mind, as to whether it isn't politics rather than the best interest of this country that is holding back the air arm.

If that is too personal, Admiral, to ask a question like that, I will withdraw it.

Admiral Reeves: I don't think I understand your question. Are you asking whether we should have an independent air force or are you asking how the Fleet meets an air attack?

Mr. Dolan: Neither. We have the biggest Naval Fleet in the world, and the other country has the biggest air fleet in the world. Where do they clash?

Admiral Reeves: I don't know.

Mr. Dolan: By that I mean, Admiral, if a large naval fleet's range of fire is 40,000 yards, and it is standing outside of San Francisco Harbor, and your air fleet is stationed in the interior a hundred miles, and is sent to bombard Japan—how can the Naval Fleet counter that?

Admiral Reeves: Let me answer your questions or question in this way: First, in regard to a separate air force, that is a question as old as Billy Mitchell or older. Let me answer it, first, in a technical way. As engineers, you may appreciate this approach.

A specialist is a man who has narrowed or restricted his study, his endeavor, to fit himself for one occupation, so that change to another involves a loss in utility. That is specialization. You are all specialists here, if you are engineers. The word "engineer," I think, includes a score or more types of engineers. There are civil engineers and there are other kinds. Each is a specialist. Each of you gentlemen has specialized in his own profession so that you are an expert in that profession, and your transfer to another would involve a loss in utility.

The same thing applies to aviation, to fliers. There are all kinds of pilots—men who are qualified to fly one type of plane, or to fly a plane for one mission only. In the Navy we have these various types of planes that I have told you about. A regular naval aviator is qualified to fly any one of those types of planes, but these 16,000 men that we are going to train, the reserve aviators that we are going to take in our Navy for a specific purpose, are trained to fly only one type of aircraft—the fighter or the flying boat or the dive bomber—and their employment will be in that type of plane alone. Each aviator narrows and restricts his endeavor and his study and his experience to become an expert in that one type of naval airplane.

Now, when we come to the broader specialization of naval aircraft and military aircraft and consider what the Navy aircraft's mission is and what the Army aircraft's mission is, it is obvious that those missions are totally different. To be sure, they are all engaged in what is called the art of war. You can't have an expert in all branches of warfare; otherwise, you wouldn't need Army officers and Navy officers as such—you would have a master expert in warfare, capable of land campaigns and of sea campaigns. You can't have a specialist in more than one profession; otherwise, he isn't a specialist; otherwise, he is not an expert.

Our naval mission calls for naval men to operate naval aircraft with the highest degree of efficiency. If what I have said hasn't illustrated that, I have missed making the point that I tried to make—that these naval missions and naval performances and naval operations call for men who know naval work to carry them out with maximum efficiency. And the Army requires for its maximum efficiency experts in land campaigns against armies and fortifications to carry out army missions. They will have a higher degree of efficiency with their own men restricted to that particular profession who are qualified to perform those special missions.

If you have a unified air force to be used by the Army, to be used by the Navy, to perform Army functions, to perform Navy functions, there is of necessity a loss in utility, a loss in efficiency; and it is a serious loss. An aviator, no matter how skilled a pilot, is practically useless in the Fleet until he has had Fleet training. Our aviators who come from Pensacola can fly airplanes skillfully, but they can't perform naval missions. They don't know the tactics, the technique of the Fleet. To learn that they have to live in the Fleet day and night. How do you think we carry out that spotting business I told you about? Because the naval officers who do it live, day and night, year in and year out, aboard ship doing that one thing and that thing alone; that is why they can do it. Do you think an Army aviator could come out and spot our gunfire? It is simply humanly impossible. Do you think a naval aviator can join the Army and perform efficiently the missions of Army aviation? It is humanly impossible. Do you think the same man will have the same degree of efficiency if he tries to master that profession and this profession in the Army and in the Navy? A loss in utility, a loss in efficiency—a unified air force means that. That is one answer.

Now, how the Fleet will meet these flying boats is merely the problem that has confronted the Fleet since aircraft started to fly. The Navy will have to meet that menace, that attack, when it comes, whether it comes from Tokio or from Berlin, just as it will meet any other air attack in any war with any nation. It is part of the warfare of today.

These ships that are flying thousands of miles to do their bombing, to find our Fleet and to destroy it, are themselves subject to attack every mile they fly to their target and on their return. Remember, their bomb load, their reserve, is in Berlin and in Tokio. They can fight for a few seconds while they drop their bombs. They will do damage if they hit. Before they drop their bombs they will be subject to attack. That is why the Navy needs flying boats; that is why it needs carriers and scouting planes; that is why it needs fighting planes; that is why it needs 16,000 naval aviators and 15,000 airplanes and 18 carriers, plus the auxiliaries, to meet that attack and every other attack, no matter where it comes from, no matter what base it left, or what base it returns to. It is part of the Navy's business to meet and to repel and to overcome that air attack, just as it must meet attacks from other shore based planes and from other fleet planes, as well.

In co-operation with the Army, there is a borderline at the coast where Army and Navy do co-operate, and we have joint maneuvers with the Army in the air and with their fortifications and with our surface ships. When I commanded the Fleet and we left Pearl Harbor with our carriers for our Fleet problem, I conceived the mission of the Army was to afford aerial protection while the Fleet was within the range of their shore based planes and the planes on my carriers were conserved for their mission of fighting the enemy fleet. While the Army had airplanes that could give us protection, they were used and the Army protected us, and the Navy didn't fly any airplanes from the carriers for two reasons: because the carriers were in restricted waters, but, fundamentally, because the airplanes in that Fleet were for a different purpose. When we are where we can co-operate with the Army or they can co-operate with us, the Army and Navy co-operate. That is why the Army and Navy hold joint maneuvers. But the Navy doesn't try to do the Army's work, and the Army doesn't try to, and can't do, the Navy's work. The range of their usefulness ceased at the range of their airplanes, and from that point we had to take over and attend to ourselves and our own security. But when we come within the range of shore fortifications and shore based aircraft, why do you think they are there? They are there to afford the Fleet a safe harbor of refuge, to give the Fleet protection and an opportunity for replenishment of ammunition and fuel and supplies, to give it a respite from its own work. That is why our fortifications and shore guns exist in fortified harbors. They exist of course also for coast defense.

The question of the Navy taking over coast defense came up years ago. It doesn't belong to the Navy. The Navy is mobile—its mission lies on the high seas, hundreds and perhaps thousands of miles from our own shores, to save this country from invasion, to meet and destroy the enemy forces before they get within a thousand miles of our homeland. That has been the policy of our Navy for years, and I think it is a sound policy.

I don't know whether that answers our friend's questions. It is merely an exposition of what I consider a practical, common sense, maximum efficiency point of view. (Applause.)

MAJOR HUIE: Admiral, I probably will go just one step further than my friends, Mr. Burpee and Mr. Dolan. Your explanation in answer to Mr. Dolan has dealt with a particular phase of what I might term the "junior" officers of the Navy and the "junior" officers of the Army. I agree with you wholly that the training of those men should be within the particular corps. However, I believe there is a far bigger and broader question in so far as a unified air force goes than just the training of the Navy aviators, no matter what their particular mission may be, or the Army aviators, whatever their mission may be.

It is quite significant that Hitler saw fit to have a unified air force before he ever saw fit to strike. It is quite significant that England saw fit to follow suit after war was declared. It is quite significant, also, that France did not see fit to follow suit. Could it be that a desire to retain the existing control of the air force in the Army and Navy is blocking unification?

PRESIDENT HENRY: Gentlemen, it seems to me that the Admiral has given his opinion on these matters, and as the time has reached eleven o'clock, which is our hour for adjournment, I suggest we adjourn now and rise in tribute to Admiral Reeves for the fine presentation of his subject, not only in its substance, but in the eloquence of its delivery. (Applause.)

The meeting adjourned at eleven-five o'clock.